Sandia National Laboratories
Waste Isolation Pilot Plant

Analysis Plan
for

Regression Testing for the Hardware Upgrade to Compaq Alpha ES40

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1.0 INTRODUCTION and SCOPE

This document details a "regression test" for the hardware upgrade to the Compaq ES40 processor, on the WIPP Regulatory Compliance Department COMPAQ Alpha Cluster. This cluster is currently running Open VMS 7.2-1. A previous regression test was conducted for VMS 7.2-1 (Regression Testing for the Upgrade to OpenVMS Version 7.2, APO-065 Analysis Plan, Feb, 14, 2000 and results contained in Analysis Package for Regression Testing the Upgrade to OpenVMS Version 7.2, AP-065, WBS#1.4.01.06.01.01). The title of the report (OpenVMS Version 7.2) reflects the major and minor version levels and not the patch level that was tested. While OpenVMS 7.2-1 was the exact version tested the analysis plan author determined that listing the patch level was not required.

The purpose of this test is to demonstrate that the hardware upgrade will have no significant undesirable affects on the WIPP PA application software. Portions of this test will also serve as the installation and checkout for the specific versions of the application software identified in Section 2.1 of this document. This test focuses solely on the effect of the upgrade on the WIPP PA application software. It does not address other system related issues such as possible effects on the system backup and archiving software and the Configuration Management System.

1.1 PARTICIPATING PERSONEL

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1.2 TRAINING REQUIREMENTS

There are no special training requirements for this testing. All participants, listed above, are already fully trained and will be functioning within their normal job descriptions.

1.3 ESTIMATED SCHEDULE

The testing described in this document will adhere to the following estimated schedule:

1. Begin Preparation of Testbed Machine: 09/14/01
2. Testbed machine ready for use: 09/17/01
3. Begin Testing: 09/27/01
4. Complete Testing: 10/31/01
5. Complete Analysis Package: 11/30/01

2.0 COMPAQ ALPHA CLUSTER OVERVIEW

The COMPAQ Alpha Cluster is the main calculational platform for the WIPP Regulatory Compliance Department. The performance assessment calculations for the Compliance Certification Application (CCA) (see reference [1]) were performed on the platform in 1996, and more recently, the PA Verification Test (PAVT) (see reference [2]) for the Environmental Protection Agency were performed on this platform in 1997.

The cluster consists of 11 COMPAQ Alpha 2100 computers, and a new COMPAQ Alpha ES40, all of which currently run Version 7.2-1 of the OpenVMS operating system software. The majority of the WIPP PA application software codes execute on this platform. While version 7.2-1 of OpenVMS is still supported by Compaq Computer Corporation it is generally recommended that users upgrade to version 7.3 to minimize complications in the maintenance of software. A decision to remain with version 7.2-1 was made due to complications with the automated tape system backup software upgrade. A regression test of OpenVMS 7.2-1 was already conducted on the Compaq Alpha 2100's. The purpose of this testing is to demonstrate that the hardware upgrade to the ES40 class machine will have no significant adverse affect on the performance of the application software.

2.1 WIPP PA APPLICATION SOFTWARE

The following WIPP application software codes will be used for the testing described in Section 2. This list of codes was taken from the SNL WIPP BASELINE SOFTWARE LIST (see reference [4]) and constitutes, with three exceptions, the latest versions of all WIPP software, both PA and Non-PA, currently qualified on the COMPAQ Alpha Open VMS 7.1 platform. It is intended that the testing conducted under Test #1, Section 3.1, will constitute an Installation and Checkout for this software, to qualify it for use on the new ES40 platform.

Code list for Test #1

Code Name	Version	Executable Name
ALGEBRACDB	2.35	ALGEBRACDB_PA96.EXE
BLOTCDB	1.37	BLOTCDB_PA96.EXE
BRAGFLO	4.10.01	BRAGFLO_QA0410A.EXE
CCDFGF	3.01	CCDFGF_QA0301.EXE
CCDFSUM	2.01	CCDFSUM_QA0201.EXE
CUTTINGS_S	5.04A	CUSP_QA0504A.EXE
EPAUNI	1.14	EPAUNI_PA96_2.EXE
GENMESH	6.08	GM_PA96.EXE
GROPECDB	2.12	GROPECDB_PA96.EXE
ICSET	2.22	ICSET_PA96.EXE
LHS	2.41	LHS_PA96_2.EXE
NUTS	2.05A	NUTS_QA0205A.EXE
PANEL	4.00	PANEL_QB0400.EXE
POSTBRAG	4.00	POSTBRAG_PA96.EXE
POSTEPAUNI	1.15	POST_EPAUNI_QA0115.EXE
POSTLHS	4.07	POSTLHS_PA96.EXE
PREBRAG	6.00	PREBRAG_PA96.EXE
RELATE	1.43	RELATE_PA96.EXE
SPLAT	1.02	SPLAT_PA96_2.EXE
STEPWISE	2.21	STEPWISE_PA96.EXE
SUMMARIZE	2.20	SUMMARIZE_QA0220.EXE

2.2 Codes not included in the regression test

Two codes will not be tested at this time, due to pending changes in the SDBREAD_LIB library. The two codes are MATSET version 9.05 (MATSET_QA0905.EXE) and PRELHS version 2.25 (PRELHS_QA0225.EXE). These codes will require QA testing prior to being run on the ES40 platform.

2.3 APPLICATION SOFTWARE LIBRARIES

The following software libraries, also taken from the SNL WIPP BASELINE SOFTWARE LIST, are necessary to the building of the code executables and will be used as part of Test # 2 (Sections 3.2).

Code list for Test #2

Library Name	Version
CAMCON_LIB	2.19
CAMDAT_LIB	1.24
CAMSUPES_LIB	2.21
PLT_LIB	2.03
SDBREAD_LIB	3.01

3.0 TEST DESCRIPTION

The testing will consist of two test cases, which are described in the following sections. The testing will be conducted on the ES40 and will be set up by the COMPAQ Alpha Systems Manager. Tests will be conducted on the ES40, while it is configured as a member of the OpenVMS 7.2-1 cluster. All files needed for the tests will be extracted from CMS as needed. Since the ES40 will be part of the cluster, there is no need to copy files between systems. All tests will be run on the ES40. If it is necessary to make some comparison runs on the Alpha 2100's, these will be made on BEATLE, which is also part of the cluster. All results from the testing will be stored in the CMS by the SCMS Librarian under the class name ES40_QA.

3.1 TEST #1

This test will consist of the running one or more "test cases" for each of the 21 qualified software application codes listed in Section 2.1 on the ES40 system. The purpose of this test is to demonstrate that the code executables, as currently qualified on the OpenVMS 7.2-1 Alpha 2100 platform, will run correctly on the ES40 without recompilation. It is desirable that this be true because if the codes do require recompilation, then they must undergo a complete regression testing in order to qualify them for use. However, if they do not require recompilation, then only an Installation and Checkout test is required. This test will serve as the Installation and Checkout test for each of the listed codes, which meet the acceptance criteria (3.1.2).

It is know that some PA codes are not able to execute using the current Fortran RTL. During testing, codes are allowed to use the previous Fortran RTL.

If any of the codes are unable to meet the acceptance criteria, then the following steps will be taken:

1. They will be identified in the Analysis Package as having failed the test
2. They will be rebuilt on the new platform once the production version of the platform is available
3. They will be scheduled for a full regression test on the new production platform in order to re-qualify them.

If problems arise that are attributed to the ES40 platform then:

1. The problem will be identified in the Analysis Package
2. The problem will be evaluated by the SCMS Auditor/Librarian
3. The appropriate remediation will be identified and applied
4. The affected codes will be retested.

The test case(s) to be run will be selected by the software tester. The criteria for this selection will be to choose one or more test cases which "touch" at least half of the required functionality. Usually, this can be accomplished with just one test case, but in some cases multiple test cases will be needed. The tester will make this determination by consulting the "Requirements Coverage by Test Case" table in the Requirements Document/Verification and Validation Plan (RD/VVP) for each code. Note, to touch all of the required functionality would in most cases

require running all the test cases which would significantly increase the amount of time and effort required for this test without delivering a corresponding significant increase in confidence.

3.1.1 Test Procedure

The following steps will be performed by the software tester:

- Examine the RD/VVP and choose the test case(s) to be run.
- Verify access to the executable as well as the input and out files for the test case(s). If files have been archived or out swapped the testing lead will work with the cluster system manager to the files restored.
- All tests will be conducted on a disk directly connected to the ES40. The disk prepared for this test is 4dka100.
- Execute the test case(s) on the test machine.
- If test case fails due to an RTL error, fetch EVAL_CCA_MASTER_FORRTLV73.COM from LIBWP and run at the $prompt (or as part of a batch job) in order to establish a logical pointer to the previous Fortran RTL , and rerun the test.
- Compare the output files generated on the test machine with those from the previous 7.2 testing. The difference between the ES40 and VMS 7.2 results can be generated by extracting the VMS 7.2 test results from CMS and running a difference command, or by using the CMS "*difference*" command.
- Evaluate the generated *difference* output file for conformance to the Acceptance Criteria. The software tester and the lead code sponsor will resolve any differences which do not conform to the acceptance criteria.
- The SCMS Librarian, at the request of the tester, will store the generated test case output files and the *difference* output files into the CMS for archival. The files will be stored in the source library for the particular code being tested under the class name " ES40_QA".

A hardcopy listing of the *difference* output files as well as the conclusions drawn from the evaluation of difference results will be documented in the analysis package for this analysis plan (see reference [5]). The Technical Reviewer will examine these listings and evaluations to verify that the acceptance criteria have been satisfied. Any code that fails to meet the acceptance criteria will be identified in the analysis package and subsequently, the problem which caused the failure will be identified and resolved by the code sponsor, and the code will be fully retested on the new platform.

3.1.2 Acceptance Criteria

There will be some differences between the two sets of output files. The following types of differences are expected and are completely acceptable:

- Differences due to run dates and times
- Differences due to different file names
- Differences due to different directory names
- Differences due to different user names
- Differences due to platform and system version.
- Minor numerical differences.

It is the responsibility of the Technical Reviewer of the Analysis Package for this plan to decide whether any numerical differences are acceptable.

3.2 TEST #2

This test consists of exercising the five WIPP PA application software libraries listed in Section 2.2 on the ES40 testbed platform. The purpose of this test is to verify that the libraries function as expected on the new platform. This test will not constitute an installation and checkout of these five libraries on the ES40. This test will demonstrate that there are no hardware (i.e. ES40) dependencies inherent in the libraries, and therefore future code builds may be conducted on the Compaq 2100 platforms, or on the ES40.

3.2.1 Test Procedure

Regression tests will be run for the five libraries. The test cases will be executed by the software tester. The procedure is as follows:

- Since the ES40 will be part of the cluster, no duplication of files or CMS libraries is required.
- No builds are required.
- Execute all test cases for the five libraries as defined in the corresponding RD/VVP's.
- Compare the output files generated on the ES40 platform with those from the OpenVMS 7.2 regression tests, extracted from CMS using either the OpenVMS or CMS *difference* command (specify the existing results used to compare).
- Check all differences against the acceptance criteria.
- Save the generated output files and difference output files in CMS on the cluster.

A hardcopy listing of the *difference* output files as well as the conclusions from the tests will be documented in the Analysis Package for this analysis plan (see reference [5]). The Technical Reviewer will examine these listings to verify that the acceptance criteria have been satisfied.

If a library fails to meet the acceptance criteria for one or more of its test cases, the following steps will be taken:

1. The failure will be documented in the Analysis Package
2. The problem will be investigated, identified, and corrected by the code sponsor

If such a failure occurs, it would have no effect on the existing executables used in Test Case #1, because the libraries are “linked” at build time and the existing executables are not rebuilt on the new platform. However, any code that is rebuilt in the future on the new platform will have the potential for being effected by the changes to the library. However, any code that is rebuilt will undergo full regression testing according to NP 19-1 and any effects would be discovered at that time.

3.2.2 Acceptance Criteria

There will be some differences between the two sets of output files. The following types of differences are expected and are completely acceptable:

- Differences due to run dates and times
- Differences due to different file names
- Differences due to different directory names
- Differences due to different user names
- Differences due to platform and system version.
- Minor numerical differences.

4.0 OVERALL ACCEPTANCE CRITERIA

The testing described in this document is attempting to accomplish a single purpose, the evaluation of a hardware upgrade to the COMPAQ Alpha ES40 on the WIPP PA application software codes. It is expected that such effects will be very minor. Tests #1 will provide the basis for this evaluation and is intended to serve as an Installation and Checkout (I&C) for the actual WIPP PA application software codes and versions listed in Section 2.1 of this document. The acceptance criteria for each test is documented in Sections 3.1.2 and 3.2.2.

If any code does not meet the acceptance criteria specified for Test #1, then it fails the I&C and it will undergo full testing after the problem has been resolved, in order to validate it for use on the new platform.

The decision as to whether to go ahead with the operating system upgrade for the cluster will be a judgment based upon the number and severity of problems encountered by this testing. The following will be the guidelines for this decision:

1. The codes in Test #1 should satisfy the acceptance criteria and therefore pass the I&C.
2. The test of the five libraries in Test #2 should meet the specified acceptance criteria.

5.0 REFERENCES

1. Title 40 CFR Part 191 Compliance Certification Application for the Waste Isolation Pilot Plant, October 1996, United States Department of Energy, Waste Isolation Pilot Plant, Carlsbad Area Office, Carlsbad, New Mexico.
2. SNL Fulfillment of the EPA-Mandated Performance Assessment Verification Calculation, August 1997, ERMS # 246854.
3. OpenVMS Alpha Version 7.2-1 New Features and Release Notes Manual, Order Number AA-RHZKA-TE, Compaq Computer Corporation, Houston, Texas.
4. SNL WIPP Baseline Software List, ERMS # 248640.
5. Regression Testing for the Upgrade to OpenVMS Version 7.2 APO-065 Analysis Plan (ERMS # 509464), Feb, 14, 2000.
6. Analysis Package for Regression Testing the Upgrade to OpenVMS Version 7.2, AP-065, WBS#1.4.01.06.01.01.